Red Tractor Assurance *for Farms*

Fresh Produce Scheme

Crop Module: Cucumber

Effective 1st September 2015

Red Tractor Assurance

Welcome

Red Tractor Assurance for Farms
Fresh Produce Scheme

This crop specific module for cucumber has been written to complement and avoid duplicating the generic principles of the Red Tractor Farm Assurance Fresh Produce Scheme standards. It is advisable to read the Red Tractor Farm Assurance Fresh Produce standards before reading this crop specific module. This module is designed to stimulate thought in the mind of the reader. It contains crop specific guidance and standards, where applicable, in addition to the requirements stated in the generic Fresh Produce standards.

Within this module the important requirements outlined in the crop specific standards section will be verified during the Red Tractor Farm Assurance assessment and compliance will form a part of the certification/approval decision.

Disclaimer and trade mark acknowledgement

Although every effort has been made to ensure accuracy, Assured Food Standards does not accept any responsibility for errors and omissions. Trade names are only used in this module where use of that specific product is essential. All such products are annotated® and all trademark rights are hereby acknowledged.

Notes: Pesticide Information

The Red Tractor Fresh Produce team has been working with Fera to provide tailored access to the LIAISON database for all Red Tractor Fresh Produce members. This system allows individual growers access to all information for plant protection products approved for use under the Red Tractor Fresh Produce Scheme.

LIAISON can be accessed under the Produce tab via the “Checkers and Services” page where you will also find a user manual. Searches will be filtered specifically for the crops for which you are registered. Once you have logged onto the site and clicked on the LIAISON hyperlink you will be directed to the LIAISON home screen.

You will need a username and password and these will be sent once you have registered:

http://assurance.redtractor.org.uk/rtassurance/services/Registration/members.eb .

General Introduction

Following a systematic approach will help growers identify and manage the risks involved in crop production. This module is based on a typical crop production process and food safety, health & safety, environmental and quality hazards are identified. Appropriate controls may then be established to minimise risk. Food safety and health & safety issues always take precedent over quality and environmental controls. The layout of this module follows the same structure as that used in the Red Tractor Farm Assurance Fresh Produce Standards. The content of the module is reviewed prior to the issue of updated editions. The review process considers both new developments and all relevant technology which has emerged since the last review was completed and which have been found to be both workable by the grower and beneficial to the environment. The aim is to transfer such information and technologies to growers.

Acknowledgements

Red Tractor Farm Assurance Fresh Produce gratefully acknowledges the contribution of all consultees in the preparation of this protocol, particularly Derek Hargreaves.

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ADDITIONAL REQUIREMENTS AGAINST CURRENT STANDARDS

None for this crop module

CROP SPECIFIC STANDARDS

STANDARDS	HOW YOU WILL BE MEASURED	RECORDS (to be kept for 2 years)
CQ.69.a **The previous crop must be cleaned up before its removal from the greenhouse**	■ If two-spotted spider mite and/or broad mite are a problem in this or the previous crop, they are treated before they enter diapause with a high volume spray of abamectin, at least twice at five day intervals ■ If aphids are present in the old crop pymetrozine is sprayed as necessary before crop removal ■ WFT is controlled during the life of the crop using biological control so that populations do not present a threat in carry-over	

STANDARDS	HOW YOU WILL BE MEASURED	RECORDS (to be kept for 2 years)
CQ.69.b **At the end of cropping you must remove the crop, weeds and all debris and dispose of them**	■ Disposal is achieved either by removing off site (ensuring the load is covered), or burying on site and spraying the soil surface with a disinfectant	
CQ.69.c **Where debris is left in a skip awaiting collection it must be covered with plastic sheeting**	■ Any plastic sheeting that has been used on the floor is rolled up with debris inside and recycled	
CQ.69.d **Inside the glasshouse, including heating pipes, irrigation lines, drip pegs, hoses, crop wires and other equipment used in the glasshouse, must be washed down and treated with disinfectant (e.g., gluteraldehyde, peroxyacetic acid, benzoic acid etc)**		■ Cleaning records
CQ.69.e **Pest activity in the empty glasshouse must be monitored. Traps must be examined regularly for pests and appropriate action taken if any are caught**	■ Before replanting trap monitoring and treatments are continued in empty glasshouses until no further pests are found	■ Trap monitoring records
CQ.69.f **Before new plants are placed in glasshouses new traps must be hung and should be assessed and replaced regularly throughout the life of the crop**		■ Trap monitoring records
CQ.69.g **Before replanting and at regular intervals during the season you must destroy all weeds around the glasshouse**	■ Weeds are destroyed by using non-hormone herbicides of short persistence or by mowing	
CQ.69.h **Disinfectant foot dips must be placed at the entrance to all glasshouses and used by all on entry**	■ Use suitable disinfectant – and ensure foot dips are maintained and used	
CQ.69.i **There must be designated areas for eating / drinking / smoking which are separate to the cropping areas**	■ Designated areas are clearly signed ■ Cropping areas are clearly signed with 'no eating / drinking / smoking' signs	
CQ.69.j **The rates of introduction of biological control measures must be based on recommendations of the biological control suppliers**		■ Records of the introduction and monitoring of biological control agents
CQ.69.k **To assist in the correct calculation of irrigation, volume of run off must be measured and samples analysed for nutrient content to ensure the correct quantity of nutrients are applied**	■ Samples of nutrient solution are analysed for nutrient content at least monthly	■ Records of measurements of run-off ■ Records of nutrient content of irrigation run-off
CQ.69.l **Written procedures must be in place in case of an oil spillage**	■ Adequate procedure to prevent environmental contamination	■ Records of oil spillages

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GUIDANCE

CHOICE OF VARIETY OR ROOTSTOCK AND PLANT HEALTH CERTIFICATION

STANDARD OF PROPAGATED MATERIAL - BUYING IN PLANTS

Growers should visit their propagators to inspect their plants prior to delivery.

Most nurseries now buy plants in from external propagators and it is important to ensure that the propagator complies with the requirements set out. Growers should formalise the supply contract with their propagators and agree to the various standards required, stipulating the pesticides that can be used and the size of plant at delivery etc. Growers should ensure their supplier adheres to their contractual requirements by requesting records of plant treatments and visiting to inspect plants before delivery.

It is recommended that for the benefit of both parties, plants should be carefully inspected on delivery and any concerns/complaints notified immediately to the propagator. Pesticide application records should also be checked to ensure there will be no conflicts with biological control used in cropping.

E. coli and food poisoning

The risks from food poisoning organisms in this crop are minimal but both the propagator and the grower should be aware of the risks from contamination with animal manures and dirty water. See generic protocol for further details.

SITE AND SOIL MANAGEMENT

SPECIFIC HYGIENE MEASURES

"Old crop" removal

The previous crop must be 'cleaned up' before its removal from the greenhouse as follows:

a. If two-spotted spider mite and/or broad mite are a problem, they should be treated before they enter diapause with a high volume spray of abamectin, at least twice at five day intervals.

b. If aphids are present in the old crop spray with pymetrozine as necessary before crop removal.

c. It is most important that WFT is controlled during the life of the crop using biological control so that populations do not present a threat in carry-over. With the reduction in effect of spinosad it is most important to maintain good control using biological control because there are no new materials coming along to replace it.

At the end of cropping, remove the crop, weeds and all debris and dispose of them in a suitable manner by either removing off site (ensuring the load is covered), or burying on site and spraying the soil surface with a suitable disinfectant.

Where debris is left in a skip awaiting collection, cover it with plastic sheeting. Where plastic sheeting has been used on the floor, roll it up with debris inside and recycle if possible.

Wash down the glass structure inside the glasshouse and then treat with a suitable disinfectant (e.g., gluteraldehyde, peroxyacetic acid, benzoic acid etc). Formaldehyde use is strongly discouraged. Also treat the heating pipes, irrigation lines, drip pegs, hoses and other equipment used in the glasshouse and wipe down crop wires with a disinfectant.

If the crop is grown in an isolated substrate, the substrate should be, where possible, reused for more than one crop.

Where isolated substrates are reused, they should be sterilised at the end of the season.

Sterilise soil or isolated substrates intended for re-use with steam - unless organic crops are being grown - when permission should be sought from your organic standards authority.

Monitor pest activity in the empty glasshouse by using yellow sticky traps. Maintaining glasshouses at 17°C will increase the activity of any remaining pests. Examine the traps regularly for pests and take appropriate action if any are caught:

Repeat the trap monitoring and treatments in the empty glasshouse before replanting, until no further pests are found. A ring can be drawn round low numbers of pests on sticky traps for monitoring purposes, but if large numbers are present, the traps will have to be replaced after each space treatment.

Environment

Destroy all weeds around the glasshouse before the new crop arrives and at regular intervals during the season using non-hormone herbicides of short persistence or

by mowing. Several common weeds (eg. chickweed, sowthistle, and dandelion) are known to host cucumber mosaic virus (CMV) and could act as a source of this virus for a cucumber crop. Weeds may also be means of carry-over of other virus diseases (e.g. TSWV or BPYV). Dandelions can also carry-over powdery mildew from one crop to the next.

New crop establishment

Before the new plants arrive, old sticky traps should be removed. New traps should then be hung in the glasshouse and should be assessed and replaced regularly throughout the life of the crop. Effective monitoring of these traps is an essential element of pest control.

The cleanliness and temperature of the vehicles used to transport plants to the production site should be checked to ensure it is adequate - particularly where vehicles have previously been used to transport produce.

Trays containing the new season's plants should be clean and then be placed only on a clean surface (e.g. new polythene, disinfected and rinsed concrete). For crops grown in rockwool slabs, any previously used slabs should be sterilised with steam and re-used where possible.

Place disinfectant foot dips at the entrance to each glasshouse block - and make sure everyone uses them. Keep them inspected and re-filled as needed.

***E.coli* and food poisoning**

Following the problem in northern Germany in 2011 it is even more important to ensure there are no risks from food poisoning organisms in your crop. The risks to cucumber are minimal but both the propagator and the grower should be aware of the risks from contamination with animal manures and contaminated water. See generic protocol for further details.

Hygiene

To avoid problems with crop contamination and also to reduce any risk of plant diseases being brought into cropped areas, no food should be brought into or consumed in any area where crops are being grown. In most circumstances clearly defined areas should be set aside for eating and drinking. These should be clearly signed. Smoking areas, where they are provided, have to be outside by law and must be restricted to non-cropped areas and any designated areas should be clearly signed.

Glasshouses must have appropriate "No Smoking / No Food" signs and that staff are provided with a clearly defined area to eat/drink.

ENVIRONMENTAL PROTECTION & CONTAMINATION CONTROL

THE BASIC APPROACH TO CROP PROTECTION

Key principles of ICM for protected salad crops

a. Biological, environmental and cultural methods of pest and disease control must be used as the first line of defence.

b. Chemical pesticides are only to be used when biological controls are not available or shown not to be working.

c. The crops must be monitored at least weekly and records made of pest, disease and biological control organism levels.

d. Records should be kept of introduction of biological control agents.

e. Correctly calibrated climate control computers should be used to ensure a suitable environment is maintained at all times.

f. Records must be kept of all pesticide applications.

Adaptation for new pests and diseases

The occurrence of a new disease or pest problem is largely unpredictable. It may arise, for example, when a previously non-indigenous disease or pest becomes established in the UK (e.g. WFT), with a change in variety or cropping practice (e.g. switch from soil to substrate cropping) or when a pathogen / pest previously controlled by a particular pesticide develops resistance. In all these situations it may be necessary to implement additional pesticide treatments.

A proposed schedule for controlling 'new' pest or disease problems, in order of priority, is described below.

a. A new pest or disease may be subject to statutory action by Fera and this should be established before taking further action.

b. The key objective is that the organism is controlled by means of a change in glasshouse environment, crop culture, biological or other non-chemical method. In some situations however, it is possible that additional use of pesticides may be necessary, at least in the short term or until a suitable alternate variety with genetic resistance is available. Such new varieties should be incorporated into the cropping programme, as they become available, providing they meet the end-market specifications.

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c. The 'new' pest or disease situation may be controlled by selecting products already known to be compatible with the biological control measures.

d. If none of these pesticides provide effective control, advice should be sought on a suitable alternative product, currently approved for use on the appropriate protected crop under Control of Pesticides Regulations (1986) (As amended 1997) now being replaced by the Biocidal Products Regulations (2001) (As amended).

APPROVED USES NOT INCLUDED ON THE PRODUCT LABEL

In many circumstances, particularly for minor crops, product labels do not include all of the approved uses and growers wishing to check the approval notice of a particular product should note that this information is available using the LIAISON® search accessible via their Red Tractor Farm Assurance home page after logging in. These "Off-Label" approvals were styled "Specific Off-Label Approvals (SOLA) but are now called "Extensions of Authorisation of Minor Use" (EAMU).

A search on LIAISON® database under "Extension of Authorisation for Minor Use" should yield a results page. A click on the product name should link to a summary of the approval information. Near the bottom of the summary is the EAMU number (e.g. 0246/09) and this link will open up a pdf of the current EAMU document giving details of the extension of use.

For various reasons the use of some approved pesticides may not be acceptable to some multiple outlets or processors. In order to conform to such requirements, proposed applications should be confirmed with the contracting company.

TRAINING REQUIREMENTS

Pest and disease identification

Staff working regularly on protected crops should be able to recognise the following pests and diseases:

- Powdery mildew
- Downy mildew
- Botrytis (grey mould) on leaves, stems and fruit
- Black stem rot (Didymella syn. Mycosphaerella)
- Penicillium stem rot
- Pythium root and stem base rot
- Various relevant virus diseases: in particular
- Cucumber Mosaic virus
- Green Mottle Mosaic virus
- Beet Pseudo Yellow virus
- Melon Necrosis virus
- Tobacco Necrosis virus
- Glasshouse whitefly
- Bemisia whitefly
- Spider mites and other mites
- Caterpillar damage
- Leaf miner damage
- Leaf hopper damage
- Thrips

Staff should know who to report to when the above pests and diseases, or other problems regularly found on a particular nursery, are first detected during the season. Managers and supervisors should appreciate the relative risk to their crops from the relevant pests and diseases.

In service training

Training in identification of pests and diseases, their damage and their biological controls and an appreciation of the objectives of this protocol should be given to each new member of staff.

All staff working on the nursery, both regular and casual, should be instructed as necessary to satisfy COSHH requirements with respect to pesticide treatments, and to satisfy the requirements of the General Food Hygiene Regulations.

Monitoring

Regular monitoring of the biological control agents, pests and diseases is of vital importance. It is essential that all crops are walked at least once a week and records kept of each inspection. All nursery staff should be alert to fresh pest or disease symptoms or signs of imbalance with biological control mechanisms.

PEST CONTROL

Ensure all picking boxes, trolleys, tractor tyres, footwear and any associated tools and equipment are kept thoroughly clean. Treat routinely with an appropriate disinfectant and routinely wash clothing and gloves.

Store cleaned boxes and equipment carefully to avoid re-contamination.

After using disinfectants in the glasshouse thoroughly ventilate the house to remove all traces of vapour. Rinse picking trays with water after treating with the disinfectant.

Biological control organisms (BCOs)

The table below lists currently available biological control measures. The rates of introduction should be based on recommendations of the biological control suppliers. The introduction and monitoring of biological control agents must be recorded.

Pest	Control	Notes
Glasshouse whitefly (*Trialeurodes vaporariorum*)	a) *Encarsia formosa* b) *Amblyseius swirskii* c) *Beauveria bassiana* (Naturalis-L®) d) *Verticillium lecanii* (Mycotal®) e) Yellow sticky traps	b) may also control other pests d) and e) for corrective action
Sweet potato or tobacco whitefly (*Bemisia tabaci*)	Statutory control in UK (inform Fera Plant Health and Seeds Inspectorate)	This pest was found in UK crops in 2013 - check your crop regularly for this alien pest. Treatments as for glasshouse whitefly may be permitted by PHSI
Spider mites (*Tetranychus urticae*)	a) *Phytoseiulus persimilis* b) *Amblyseius californicus* c) *Feltiella acarisuga* d) *Beauveria bassiana* (Naturalis-L®) e) Eradicote® /Majestic®	b) not proving to be as effective as first thought
Western flower thrips (WFT) or onion thrips (*Frankliniellaoccidentalis* or *Thripstabaci*)	a) *Amblyseius cucumeris* b) *Amblyseius swirskii* c) *Orius* spp d) *Beauveria bassiana* (Naturalis-L®) e) *Verticillium lecanii* (Vertalec®) f) Eradicote® /Majestic®	a) standard treatment b) for corrective action c) difficult to establish
Melon cotton aphid (*Aphisgossypii*) and other aphid species	a) *Aphidius colemani* b) *Aphidius ervi* c) *Beauveria bassiana* (Naturalis-L®) d) Eradicote® Majestic®	a) regular introduction required
Broad mite (*Polyphago - tarsonemuslatus*)	a) *Amblyseius cucumeris* b) remove small foci of affected plants	Occasional pest only. Do not introduce biological control agents on leaf material
French 'fly'	Usually only a pest of crops grown on straw bales	Amblyseius used for WFT will normally give adequate control
Leaf miners	Not usually a pest on cucumbers but in recent years has increased to damaging levels. As there are a number of leaf miners occurring on cucumber they should be identified correctly a) leaflet removal plus b) and c) b) *Dacnusa sibirica* c) *Diglyphus isaea* If confirmed as non-indigenous species, statutory control measures will be stipulated by PHSI. Biological control may be permitted	
Leaf Hopper (*Hauptidia macroccana*)	a) Removal of infested leaves and use of yellow sticky traps are very effective at keeping populations low b) *Anagrus atomus*	Leaf Hopper infestations are increasing in frequency and it is important to control at an early stage
Caterpillars	a) Hand picking b) *Bacillus thuringiensis*	b) most effective when applied to small larvae

Notes:

The use of the predatory bug *Macrolophus callignosus* is not recommended for cucumbers because of its effects on other beneficial organisms and the possibility of it causing plant/flower damage.

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Chemical control: For some pests biological controls are not available and suitable pesticides are recommended.

Pest	Active ingredient	Notes
Whitefly	a) spiromesifen b) dodecylphenol ethoxylate (Agri 50 E®) c) fatty acids	Double *Encarsia* introduction for three weeks after any whitefly spray treatment a) can be damaging to *Phytoseiulus* *Bemisia* found in organic crops last season - check any infestations for type - infrom PHSI if alien species found
Spider mites	a) spiromesifen b) abamectin	a & b) can be damaging to *Phytoseiulus* b) spot treatment only in mature crop
Aphids (*A. gossypii*)	a) pymetrozine b) thiacloprid	Use products with a different mode of action to avoid resistance. c) thiacloprid damages biological control and use should be restricted to spot treatments and clean up b) although thiacloprid is still approved for use it is felt that its use should be resricted during the moritorium on field use
Other aphid species	a) pirimicarb b) pymetrozine	Limited data shows pymetrozine is reasonably safe on biological control agents
Broad mite	a) abamectin	As spot spray
Western flower thrips	a) spinosad	a) early treatment needed to prevent thrips damaging fruits Biological control has to be the first line of control for WFT as spinosad is no longer very effective
Palm thrips (*Thrips palmi*)		a) found in the UK - notify Plant Health if thrips that you do not recognise are found in the crop. *Thrips palmi* are very similar in appearance to Onion thrips b) palm thrips spreads viruses such as Spotted Wilt
Leaf Hopper	a) indoxacarb	a) HDC trials have shown useful effects on leaf hopper
Caterpillars	a) hand picking b) indoxacarb c) deltamethrin	c) deltamethrin is very persistent and damaging to biological control, only use as an end of season clean up treatment

DISEASE CONTROL

Certain diseases are relatively common and occur on most holdings each year. The procedure for the control of the common disease problems is given in detail, and the procedure for other diseases is only given in outline. Further technical advice should be sought as necessary.

It cannot be emphasised too strongly that regular crop monitoring with rapid and accurate disease identification and an appropriate rapid response involving roguing of the affected plant, cultural changes, a glasshouse environmental change, or fungicide treatments, is essential to fulfil the objective of minimising fungicide use.

All crops should be walked and inspected for disease at least once every seven days. If a disease is overlooked or seen but no action taken, then several fungicide applications may be required to bring the problem under control, compared with perhaps one or two applications if prompt action is taken.

Botrytis

Preventative action	Spray decision parameter	Fungicide
General		
Control relative humidity (RH). Ensure RH does not rise above 85% for more than a few hours		
Remove debris after trimming		
Allow crop to dry before nightfall after spraying		
On young plants		
Avoid damage at planting	Treat if obvious damage	cyprodinil + fludioxonil
In the growing crop		
If no *Botrytis* in the crop and no extended periods of RH >85%	No treatment	
If *Botrytis* is present in the crop or if RH is >85% for long periods or if *Botrytis* occurs most years	Check RH records and equipment for accuracy Preventative spray to stem after trimming	cyprodinil + fludioxonil
	Further sprays immediately after trimming or if RH >85%. Alternate fungicide groups to reduce the risk of resistance	cyprodinil + fludioxonil

Black stem rot

Preventative action	Spray decision parameter	Fungicide
General		
Ensure RH does not rise >85% for more than a few hours - restrict irrigation period to start at least 2 hours after sunrise and end at least 2 hours before sunset		
Remove debris regularly, well away from crop		
Minimise overhead watering where possible		
Remove old crop before re-planting		
On young plants		
Avoid damage at planting	Main risk is in replanted crops; aim at stem base. Alternate fungicide groups to reduce the risk of resistance	cyprodinil + fludioxonil / azoxystrobin / fenhexamid[(1)] / myclobutanil[(1)]
On stems, leaves and fruit		
Check RH control		
Allow stems to dry after trimming or preventative spray to stem after trimming	Start spraying programme as soon as disease appears. Repeat every 7-14 days. Preventative spray aimed at stem immediately after trimming	cyprodinil + fludioxonil / azoxystrobin / fenhexamid[(1)] / myclobutanil[(1)]

Notes:

[(1)] Recent HDC funded work has indicated that the use of fenhexamid and myclobutanil may reduce the activity of *Mycosphaerella*.

Reduced disease control will occur where resistant isolates are present. Apply no more than two applications of the same active ingredient in any course of treatment and allow as long as possible before further treatment to avoid a build-up of resistance.

Sprays applied every 7-10 days are more effective than fortnightly sprays, especially when conditions are very humid.

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Powdery mildew

Preventative action	Spray decision parameter	Fungicide
General		
Control humidity but do not over-ventilate on the wind side of the greenhouse, inspect crops regularly, control weeds (esp. sowthistle and dandelion), remove old crop before replanting		*Ampelomyces* (AQ10®) can give protection but should be applied before infection occurs and then repeated every 7 days to maintain protection
Following initial discovery		
Remove affected leaves (if few) Apply fungicide immediately	Alternate products from different fungicide groups to reduce the risk of resistance	Garlic extracts are effective or use - cyflufenamid(1), myclobutanil, potassium bicarbonate or azoxystrobin(2)
Continuing mildew development		
	If mildew continues to increase on young plants	cyflufenamid(1), myclobutanil or azoxystrobin(2)
Severe mildew	Seek advice	bupirimate(3)

Notes:

Better varieties with tolerance to mildew are now becoming available; most are suitable for later or replanted crops.

(1) cyflufenamid is only approved for two applications per crop - but is very effective when used at full rate and reduced volume - apply early in any outbreak to obtain control.

(2) azoxystrobin is less effective because of resistance.

(3) Do not use bupirimate on young plants because of foliar damage; monitor effect.

Pythium

Preventative action	Spray decision parameter	Fungicide
General		
Sterilise soil/use new or sterilised slabs. Stand plants only on clean surfaces. Use mains or borehole water. Avoid cold, wet soil/slabs. Also avoid irrigating with hot water in re-plant period. Leave gap between slabs to prevent movement of *Pythium* between young plants		*Tricoderma* (Trianum®) *Gliocladium* (Prestop®) May give some protection
Precautionary fungicide treatments		
Drench roots and stem base immediately after planting	Substrate crops	fosetyl aluminium + propamocarb hydrochloride(1)
Following initial discovery		
Check drainage. Treat adjacent plants	Substrate crops	fosetyl aluminium + propamocarb hydrochloride(1)
High incidence of *Pythium*		
Sterilise soil. Use new slabs. Check hygiene	Seek advice	

Notes:

(1) maximum of two fosetyl aluminium + propamocarb hydrochloride treatments per crop.

Less common diseases

Disease	Comment	Action
Phytophthora root rot	Uncommon - mostly found in soil crops	propamocarb hydrochloride (1) or fosetyl aluminium + propamocarb hydrochloride (1) Sterilise soil
Rhizoctonia stem base rot	Uncommon - mostly found in soil crops	Sterilise soil. Treat with cyprodinil + fludioxonil spray
Black root rot (*Phomopsis*)	Can be devastating - mostly found in soil crops but becoming more of a problem in rockwool	Remove infected slabs, good hygiene at pre-planting - keep soil covered with plastic and out of irrigation when fitting laterals / drippers
Sclerotinia	Occasional disease	Remove affected plant parts, cyprodinil + fludioxonil may be useful . Sterilise soil or use *Coniothyrium minitan*s to soil before planting
Penicillium stem rot	Increasingly common	Remove affected plants. Control humidity.
Gummosis or scab (*Cladosporium cucumerinum*)	Rare	Most varieties resistant. Remove affected parts. Control humidity
Verticillium wilt	Rare - mostly in soil crops but recently in rockwool	Sterilise soil. Remove affected plants
Fusarium wilt	Increasing. Mostly in soil crops but recently in rockwool	cyprodinil + fludioxonil may have some effect on *Fusarium* Sterilise soil. Remove affected plants
Downy mildew	Occasional - can be devastating, spreads very quickly	Check imported plants. Control humidity and keep plants dry. Metalaxyl-M and azoxystrobin are effective
Alternaria, *Stemphylium* and *Ulocladiumleaf* spots	Uncommon	Remove affected leaves, control humidity and keep plants dry
Angular leaf spot (*Pseudomonaslachrymans*)	Rare - occurs at high temps (>24°C)	Keep plants dry

Notes:

(1) maximum of four propamocarb hydrochloride treatments per crop (alone or in mixture) - the approval of propamocarb hydrochloride alone expired on 31st March 2013 but use in mixture will continue.

(2) indicates the least preferred action.

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Disease	Comment	Action
Cucumber mosaic virus (CMV)	Less common but can be devastating if *Pythium* is also present	Control aphid vectors. Control weeds
Cucumber green mottle mosaic virus	Occasional - can spread quickly on hands and knives	Virus tolerant varieties are now available - where they prove to be useful they should be used. Use virus free seed. Remove affected plants as soon as they are seen. Use of milk on hands and knives helps reduce spread. Thorough clean up at the end of the crop is essential to prevent carry over into the next crop
Beet pseudo - yellow virus	Increasing in the Lea Valley area - increased risk if whitefly control is inadequate	Control whitefly with early and robust use of *Encarsia*
Cucumber pale fruit viroid	Rare - no known insect vectors	Remove affected plants
Melon necrotic spot virus	Rare - on rockwool crops - not very damaging -*Olpidium* vector. Could be risk with recirculation	Use mains water
Tomato spotted wilt virus	Rare at present	Control thrips and weeds
Tobacco necrosis virus	Rare - on rockwool crops - not very damaging -*Olpidium* vector. Could be risk with recirculation	Use mains water
Zucchini yellow mosaic virus	Rare - very distorted fruit	Control aphids

New virus - potential threat to UK crops

A new virus that is similar to Green Mottle Mosaic Virus was identified in 2002 in the Middle East and Japan. There has also been a report in the UK of a new form of Pale Green Mottle Mosaic Virus. These viruses have the potential to reduce crop yields and fruit quality so any suspicious symptoms should be investigated by appropriate specialists. More details will be made available as and when they are published. Rootstock developments including resistance to Green Mottle Mosaic Virus are coming through - this may be useful in reducing the problem.

NUTRITION AND IRRIGATION

Steps should be taken to minimise nitrate levels in applied nutrient solutions. It is recommended that water and nutrients are re-circulated - but only where thorough sterilisation is available. Because of proposed changes in legislation, growers are advised to investigate re-circulation.

In any case irrigation requirement should be closely matched to crop need and steps should be taken to minimise nutrient run off - particularly nitrate and phosphate - into soil and water courses.

To assist in the correct calculation of irrigation, volume of run off should be measured and samples analysed for nutrient content to ensure the correct quantity of nutrients are applied.

Most production areas are now in Nitrate Vulnerable Zones (NVZ) following the changes in designation - growers should be aware of the requirements of any legislation governing use of fertiliser on their nursery.

Where possible, water and nutrients should be recirculated to conserve water and also reduce any possible run-off of nutrients. It is accepted that, at this stage, the recirculation of water for cucumbers is difficult because of virus disease carry-over. But legislation may force growers to use this method to prevent losses of water / fertliser / pesticides from the site.

HYGIENE

Anyone dealing with food is affected by the Food Hygiene Regulations. This includes workers harvesting in glasshouses as well as those on graders and in halving and pre-packing departments.

As with most legislation, most of the actions you have to follow are common sense.

Cleanliness is part of the job. You must not deliberately contaminate the produce.

You must not place produce where there is any risk of contamination.

Picking boxes are for produce only. Keep them clean!

Personal washing facilities (basin, soap, etc) are for personal cleanliness only. Use them frequently.

In light of the problem caused by the *E coli* outbreak in Northern Germany in 2011 it is particularly important that produce is kept clear of any contamination and that you can demonstrate that your crop is free from contamination.

Sample supply water and diluted feeds for bacterial contamination regularly.

Glasshouses must have appropriate “No Smoking/No Food” signs and that staff are provided with a clearly defined area to eat/drink.

Smoking areas may need to be designated and shelter provided.

POLLUTION CONTROL AND WASTE MANAGEMENT

There must be written procedures for the management and recording of incidents involving oil spillages.

To avoid problems with crop contamination and also to reduce any risk of plant diseases being brought into cropped areas, no food should be brought into or consumed in any area where crops are being grown. In most circumstances clearly defined areas should be set aside for eating and drinking. These should be clearly signed. Smoking is not allowed inside any areas now and should only be allowed in designated areas outside and any designated areas should be clearly signed.

RESIDUES AND CONTAMINANTS

Red Tractor Farm Assurance Fresh Produce is aware that a key area in the production of fresh produce which requires continued attention by growers and their advisers is that of keeping pesticide residues to a minimum. This issue is not just one of meeting the MRL trading standard but ensuring that any individual or multi residues are kept as low as possible below this level.

The key targets are:

- Optimising earliest applications of fungicides and insecticides to the edible part of the crop to reduce residue at time of harvest
- Ensuring minimum harvest intervals are followed
- Ensuring that application equipment is cleaned regularly and is applying products correctly and evenly
- Ensuring all those involved in applying pesticide products are adequately trained and qualified

See the Appendix for the pesticide targets and guidelines on this crop.

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APPENDIX 1: GUIDELINES ON MINIMISING PESTICIDE RESIDUES

These guidelines have been produced after consultation between crop stakeholders and the Fresh Produce crop author. They will be developed over the coming seasons as knowledge on minimising residues develops. Growers should consult with their crop protection adviser to ensure other best practices are not compromised before considering these guidelines. There have been problems in the past with the active ingredients listed below that may give rise to crop residues and growers should be aware of the potential problems and work out alternative strategies.

Active ingredient	Target: pest, weed, disease	Current position	Suggested guidelines
azoxystrobin	Powdery mildew, *Mycosphaerella* etc	Residue found occasionally at or just above limit of determination but well below MRL	This pesticide is persistent in the crop – and even though the levels are very low Use alternative materials where available
dithiocarbamate	Seedling disease	Residue found occasionally just below the limit of determination but well below MRL	Assumed to be contamination of fruit from rubber gloves. Do not use rubber gloves when handling fruit
iprodione	No longer approved	This material is seen occasionally – assumed to be miss-use	Do not use it
metalaxyl	Downy mildew	Residue found occasionally above limit of determination but well below MRL	Use at lowest effective rate
propamocarb hydrochloride	*Pythium*	Residue found occasionally above limit of determination but well below MRL	No alternatives available. Use at lowest effective rate
pymetrazine	Aphids	Residue found occasionally above limit of determination but well below MRL	Check species of aphid present and use alternative materials if appropriate – see note on thiacloprid
thiacloprid	Aphids / thrips / whitefly	Residue found occasionally above limit of determination but well below MRL	Because of the poor activity and bad press of this material – avoid use where possible
		No other active ingredients causing residue problems	

- Pesticide use on UK cucumbers is low.
- There are no organochlorine or organophosphates insecticides approved for use on UK cucumber crops nor any herbicides, plant growth regulators or post harvest treatments.
- There have been a small number of un-approved residues found in UK product in the recent past that indicate possible import substitution rather than illegal pesticide use – both activities give a poor image of UK cucumber production.
- Integrated Crop Management strategies for pest and disease control should continue to be the key approach to be used, with emphasis on non-pesticide strategies.
- Virtually all UK commercial cucumber crops are grown in heated glasshouses. This affords the opportunity for effective deployment of biological pest control and the prevention of disease infection by environmental manipulation.
- Those pests and diseases for which pesticide intervention is still most likely to be required in the UK are aphids, WFT, spider mites, leaf miner, Pythium, downy mildew, powdery mildew and *Mycosphaerella*.

The acceptance of materials for pest and disease control through a physical mode of action as not being pesticides, and therefore not having to comply with pesticide legislation or having residue problems, should be considered. Examples are plant extracts of garlic[1], glucose polymers[2], polysaccharides[3] and fennel[4] e.g. Garshield[1], Ecospray[1], Eradicoat[2], Majestik[2], Agri-50E[3] and Fenicur[4] respectively. Recently Eradicote and Majestik have been registered as pesticides but the "active" ingredient has not changed and is still a physical mode and leaves no pesticide residue.

GENERIC RECOMMENDATIONS

1. Avoid pesticide use by:

- good husbandry, including irrigation and nutrition to maintain healthy plants.
- good site hygiene – including good weed control outside the glasshouse.
- use of clean plant material and powdery mildew tolerant cultivars.
- use of biological control agents for pest control, and when available, disease control.
- use of environmental manipulation.
- use of spray materials with physical modes of action (non-pesticides) where appropriate.

2. Minimise pesticide use by:

- Maintaining strict routines of crop monitoring to ensure that any remedial action is taken at the first opportunity for greatest effect with least sprays.
- Ensuring adequate training in the recognition of pests, diseases and biological control agents by all staff, especially crop workers, to ensure rapid and appropriate response.
- Ensuring adequate training in glasshouse environment control, for disease suppression especially.
- Maintaining and calibrating boom sprayers with care to ensure efficient spray application.
- Ensuring correct dose rate as this may vary according to the target pest and whether on or off label.
- Choosing any pesticides with careful attention to possible side effects on biological control agents.

Crop specific recommendations for cucumbers

The simple expedient of keeping the floor clear of crop waste has been shown to reduce the levels of (for example) *Mycosphaerella* substantially. If this only slows down the development of disease it is well worth the effort.

Techniques which may be used for other crops, such as increasing harvest intervals, are not generally relevant to cucumbers once harvesting has commenced since this lasts for many weeks and is carried out daily in some periods. All crops are multiple cropped usually re-planted at least once and more often twice per season.

Full details of approved pesticides EAMUs (Extension of Authorisation for Minor Use) for use on cucumber are available on the Liaison and CRD websites – details as follows:

Liaison website – **www.fera.defra.gov.uk**

CRD website – **www.pesticides.gov.uk/pestreg**

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Red Tractor Assurance

Certification Bodies

Your routine point of contact with the Scheme is through your Certification Body.

Certification Bodies are licensed by Red Tractor to manage membership applications and to carry out assessment and certification against the Standards. The table below shows which Certification Bodies apply to each enterprise.

Certification Body	Beef and Lamb	Dairy	Combinable Crops and Sugar Beet	Fresh Produce	Pigs	Poultry
NSF	✔	✔	✔	✔	✔	✔
Kiwa PAI	✔	✔	✔	✔	✔	✔
SAI Global	✔	✔	✔	✔	✔	✔
SFQC	✔	✔	✔	✔		
NIFCC (Northern Ireland)		✔				✔
QWFC (Wales)		✔				

NSF Certification

NSF Certification
Hanborough Business Park
Long Hanborough
Oxford OX29 8SJ
Tel: 01993 885739
Email: agriculture@nsf.org
Web: www.nsf-foodeurope.com

PAI kiwa Partner for progress

Kiwa PAI
The Inspire,
Hornbeam Square West, Harrogate,
North Yorkshire HG2 8PA
Tel: 01423 878878
Email: paienquiries@kiwa.co.uk
Web: www.kiwa.co.uk/pai

SAI GLOBAL ASSURANCE SERVICES

SAI Global Assurance Services Ltd
PO Box 6236,
Milton Keynes MK1 9ES
Tel: 01908 249973
Email: agrifood@saiglobal.com
Web: www.saiglobal.com/assurance

SFQC
Specialist assurance for the food and farming sectors

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Royal Highland Centre,
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NIFCC
NORTHERN IRELAND FOOD CHAIN CERTIFICATION

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QWFC

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Fresh Produce Standards